

INFORMATION FOR THE HERS PHASE II WORKSHOP  
AUGUST 26, 1999  
SACRAMENTO MUNICIPAL UTILITY DISTRICT  
ENERGY & TECHNOLOGY CENTER  
RUBICON ROOM

The notice for the August 26, 1999 HERS identified 8 issues that staff proposes for discussion at the workshop. This information package makes available background information related to three of those issues:

2. Reference House,
5. Duct Efficiency for Older Buildings, and
7. Vintage Defaults.

Reference House. Prior to the start of the separate Phase I proceeding, staff has recommended that the Title 24 Standard Design be used as the reference house in each climate zone in the state. However, the Title 24 requirements are different than the 1993 Model Energy Code (MEC), which is the basis for a score of 80 in the voluntary national home energy rating system guidelines (as proposed by the HERS Council), and a determinant of qualification for EPA's Energy Star program and associated energy efficient financing. These differences vary from climate to climate in California primarily due to the lack of consideration of the 1993 MEC for climatic conditions in California (no shading requirements, use of heating degree days as the sole climate factor) or for accepted California building construction practice (MEC requirement for slab edge insulation in relatively mild climates). Staff does not believe it is appropriate for HERS ratings in California to depend on Model Energy Code requirements that are not relevant to California climates and construction practice. On the other hand, California new construction is generally more energy efficient than 1993 MEC requirements, and that extra energy efficiency should be considered in qualification for Energy Star and energy efficient financing. Staff consulted with Sam Rashkin, Energy Star Program Manager, regarding this issue who concurred with staff that it would be advisable for California to determine a reference score for California homes based on a statewide, building starts-weighted average comparison of Title 24 vs. the 1993 MEC. Based on an analysis of the 1995 building standards assumptions and requirements, staff has previously recommended a score of 82 for the Title 24 reference house.

Staff recently has updated that analysis based on the new standards assumptions and requirements for Title 24. Attachment 1 shows the results of that analysis. The analysis used the Title 24 assumptions for programmable setback thermostat operation for both Title 24 and the MEC even though Title 24 requires a programmable thermostat and the MEC does not. Staff does not believe it is appropriate to award rating credit for programmable thermostats because field research in California has shown widely varying patterns of use for such thermostats, and staff believes other measures are substantially more reliable.

However, the use of the above thermostat assumptions causes the analysis to be conservative compared to what is allowable under the voluntary national HERS guidelines that is typically used for Energy Star analysis in other states. Those assumptions award a fairly substantial rating

credit to homes that have programmable thermostats. Staff did a sensitivity analysis (see attachment 2) that used the voluntary national HERS guidelines thermostat assumptions to assess the impact on the Title 24 reference score for Title 24 requirements (including a programmable thermostat) compared to the 1993 MEC (no programmable thermostat). This analysis shows that the Title 24 reference score based on staff's recommended analysis would be conservative compared to an analysis that awarded rating credit for Title 24 required programmable thermostats.

When the Commission divided the HERS proceeding into phases to expedite the regulations related to Title 24 field verification and diagnostic testing, CHEERS worked with other stakeholders to develop procedures to determine consistent procedures for determining Energy Star compliance (termed "C-HERS") in the absence of Commission regulations for ratings. C-HERS used the 1993 MEC requirements to determine a score of 80 in each California climate. This approach was proposed and accepted by Energy Star (although recent staff communication with Energy Star consultants indicates a continuing openness to the use of Title 24 as a higher than 80 reference). Staff is concerned that the ratings resulting from the use of the MEC as the reference produces ratings that are counter-intuitive and counter-productive across the range of California climates. Since the 1993 MEC has no shading requirements, Title 24 homes with shading get high ratings in the desert. Little needs to be done (perhaps only the use of a nominal, 62 EF water heater) to qualify for Energy Star indicating "exceptional energy efficiency" in this climate. On the other hand, since the MEC is based solely on heating degree days and requires slab edge insulation in mildclimates, like the San Francisco Bay Area, ratings using the MEC as the reference are very low in these climates, making qualification for Energy Star perhaps prohibitively difficult.

In general, staff believes that it is highly desirable for there to be a relatively consistent upgrade above Title 24 across the state as a criteria for Energy Star. A reasonable package of requirements (e.g., good duct design and sealing, high performance windows and optimal building envelope tightness) would create a consistent and equitable incentive for builders to improve on current construction practices. We believe it would be poor energy policy to establish the 1993 MEC as the reference in every California climate. However, by establishing a reference score for Title 24 based on statewide analysis of Title 24 compared to the MEC, a consistent and equitable reference score can be set across California climates resulting in a consistently achievable set of energy efficiency improvements above Title 24 that would result in an effective incentive to California builders to improve.

Duct Efficiency for Older Buildings. This issue was improperly stated in the list of issues attached to the workshop notice. The staff's intent is to revisit the following language that had previously been proposed in the December 19, 1997 HTM.

**4.3.8.2.2 Diagnostic Duct Leakage From House Pressure Test (For Existing Houses Only)**

This house pressure test as described in section 4.3.8.2.2.1 shall only be used to measure leakage on homes with vintages older than 1998. The leakage measurement shall be used to determine if the duct leakage is one of two values as shown in Table 4.7a

<b>Table 4.7a Default Leakage Values when using method in Section 4.3.8.2.2 as fraction of fan flow</b>		
Measured Leakage	$K_{\text{sleak}} + K_{\text{rleak}} > 0.34$	$K_{\text{sleak}} + K_{\text{rleak}} \leq 0.34$
Supply Duct, $K_{\text{sleak}}$	0.17	0.14
Return Duct, $K_{\text{rleak}}$	0.17	0.14

The workshop discussion should focus on whether or not this approach should be continued. At issue is whether the house pressure test is likely to be sufficiently accurate in a relatively leaky older home (both duct and envelope leakage) to be useful as a determinant of when a higher default leakage (34% compared to 28%) is warranted to represent the “before sealing” case for cost effectiveness analysis and rating purposes. If not, is there another test that should be substituted or should a default of 28% always be used (the duct pressurization test could be used to diagnostically measure the “before sealing” case).

Vintage Defaults. Attachment 3 shows the proposed default assumptions for various house vintages. The workshop discussion should identify any changes that should be made.

					ATTACHMENT1						
	ENERGY USE (kBtu/sf-yr)								BOARD		
8/11/99	MEC				T - 24				vs	CIRB	Weighted
									CA HERS	STARTS	Points*
CZ	HEATING	COOLING	WATER	TOTAL**	HEATING	COOLING	WATER	TOTAL**			
			HEATING				HEATING		% CHANGE	%	Board
1	22.02	0.02	14.15	36.19	19.22	0.01	14.15	33.38	7.76	0.900	0.0140
2	21.01	7.54	14.15	42.70	19.25	6.75	14.15	40.15	5.97	3.440	0.0411
3	13.88	1.01	14.15	29.04	13.21	1.24	14.15	28.60	1.52	2.890	0.0088
4	14.35	4.12	14.15	32.62	14.12	4.80	14.15	33.07	-1.38	4.980	-0.0137
5	12.39	1.01	14.15	27.55	11.37	0.85	14.15	26.37	4.28	0.530	0.0045
6	5.75	1.57	14.15	21.47	4.64	1.95	14.15	20.74	3.40	7.170	0.0488
7	5.88	3.33	14.15	23.36	3.76	3.29	14.15	21.20	9.25	2.640	0.0488
8	7.25	7.96	14.15	29.36	5.78	5.37	14.15	25.30	13.83	5.720	0.1582
9	7.85	12.41	14.15	34.41	6.21	9.09	14.15	29.45	14.41	2.750	0.0793
10	9.03	15.73	14.15	38.91	8.98	13.49	14.15	36.62	5.89	12.530	0.1475
11	23.83	18.24	14.15	56.22	20.22	11.76	14.15	46.13	17.95	5.110	0.1834
12	21.45	13.1	14.15	48.70	17.82	7.30	14.15	39.27	19.36	22.940	0.8884
13	17.25	25.39	14.15	56.79	14.20	16.85	14.15	45.20	20.41	8.520	0.3478
14	22.59	23.86	14.15	60.60	19.48	16.04	14.15	49.67	18.04	6.090	0.2197
15	6.15	60.97	14.15	81.27	3.64	39.19	14.15	56.98	29.89	4.290	0.2564
16	47.83	3.29	14.15	65.27	40.07	3.34	14.15	57.56	11.81	9.480	0.2240
										Total	2.6568
T-24 SETBACK T-STAT FOR BOTH CASES											

					ATTACHMENT 2						
	ENERGY USE (kBtu/sf-yr)								T -24		
8/11/99	MEC				T - 24				vs	CIRB	Weighted
									MEC	STARTS	Points*
CZ	HEATING	COOLING	WATER	TOTAL	HEATING	COOLING	WATER	TOTAL			
			HEATING				HEATING		% CHANGE	%	Board
1	24.59	0.03	14.15	38.77	19.73	0.01	14.15	33.89	12.59	0.900	0.0227
2	23.41	7.65	14.15	45.21	20.23	6.41	14.15	40.79	9.78	3.440	0.0673
3	15.35	1.18	14.15	30.68	13.84	1.13	14.15	29.12	5.08	2.890	0.0294
4	17.2	4.37	14.15	35.72	15.02	4.35	14.15	33.52	6.16	4.980	0.0613
5	15.51	1.24	14.15	30.90	11.48	0.78	14.15	26.41	14.53	0.530	0.0154
6	8.79	2.13	14.15	25.07	4.81	1.34	14.15	20.30	19.03	7.170	0.2728
7	7.66	3.49	14.15	25.30	3.95	2.94	14.15	21.04	16.84	2.640	0.0889
8	9.27	8.13	14.15	31.55	6.20	4.72	14.15	25.07	20.54	5.720	0.2350
9	9.94	12.51	14.15	36.60	6.56	8.22	14.15	28.93	20.96	2.750	0.1153
10	13.52	17.83	14.15	45.50	9.73	12.53	14.15	36.41	19.98	12.530	0.5006
11	25.88	17.9	14.15	57.93	20.98	11.12	14.15	46.25	20.16	5.110	0.2061
12	22.84	12.77	14.15	49.76	18.56	6.90	14.15	39.61	20.40	22.940	0.9359
13	20.34	25.34	14.15	59.83	14.81	15.94	14.15	44.90	24.95	8.520	0.4252
14	25.37	23.43	14.15	62.95	20.61	15.19	14.15	49.95	20.65	6.090	0.2515
15	7.86	57.89	14.15	79.90	3.84	37.42	14.15	55.41	30.65	4.290	0.2630
16	50.22	3.46	14.15	67.83	45.94	3.13	14.15	63.22	6.80	9.480	0.1289
										Total	3.6192
MEC - HERSC MANUAL SET- POINTS											
T-24 - HERSC PROGRAMMABLE OFFSET											

## ATTACHMENT 3

**2.4.1 Default Assumptions**

Table 3-7 shows the efficiency measure values currently published in the Residential ACM Manual by house vintage. Staff is proposing HERS systems must use these values in determining the home rating for conservation measures of Rated Homes when that information is not verifiable on site by raters. The SLA default values shown in Table 3-7 do not reflect the discussion about appropriate vintage leakage values for use in HERS. Table 3.4 shows the HERS infiltration values that reflect the last HERS proceeding discussions on the infiltration values that must be used when applying the calculations described in Chapter 4 unless the rater performs diagnostic tests.

Table 3-7: Default Assumptions for Existing Buildings <sup>1</sup>					
Conservation Measure	Default Assumptions for Year Built (Vintage)				
	Before 1978	1978 to 1983	1984 to 1991	1992 to 1998	1999 +
INSULATION U-VALUE					
Roof	0.076	0.047	0.047	0.047	0.047
Wall	0.386	0.096	0.096	0.088	0.088
Raised Floor -CrawlSp	0.097	0.097	0.097	0.037	0.037
Raised Floor-No CrawlSp	0.239	0.239	0.239	0.097	0.097
Slab Edge F2 =	0.76	0.76	0.76	0.76	0.76
Ducts	R-2.1	R-2.1	R-2.1	R-4.2	R-4.2
LEAKAGE					
Building (SLA)	4.9	4.9	4.9	4.9	4.9
Ducts	28%	28%	28%	28%	28%
FENESTRATION					
U-value	Use Table 1-D - Title 24, Part 6, Section 116 for all Vintages				
SHGC	Use Table 1-E - Title 24, Part 6, Section 116 for all Vintages				
Shading Dev.	Use Tables 4.3 and 4.4 for all Vintages				
SPACE HEATING EFFICIENCY					
Gas Furnace (Central) AFUE <sup>2</sup>	0.75	0.78	0.78	0.78	0.78
Heat Pump HSPF <sup>3</sup>	5.6	5.6	6.6	6.6	6.8
Electric Resistance HSPF	3.413	3.413	3.413	3.413	3.413
SPACE COOLING EFFIC.					
All Types, SEER <sup>4</sup>	8.0	8.0	8.9	9.7	9.7
WATER HEATING					
Energy Factor	0.525	0.525	0.525	0.525	0.58
Rated Input, MBH	28.0	28.0	28.0	28.0	28.0

1 Based on historic data and utility (Residential Conservation Service) conservation programs.

2 AFUE = Annual Fuel Utilization Efficiency

3 HSPF = Heating Seasonal Performance Factor

4 SEER = Seasonal Energy Efficiency Ratio

**Table 3.4 - Specific Leakage Area Minimums**

Climate Zone					
	A	B	C	D	E
Vintage of Rated Home	Before 1978	1978 to 1983	1983 to 1991	1992 to 1998	1998 to present
All	10	6.1	4.9	4.9	4.9

**TABLE 1-D—DEFAULT FENESTRATION PRODUCT U-VALUES**

<b>FRAME TYPE<sup>1</sup></b>	<b>PRODUCT TYPE</b>	<b>SINGLE PANE U-VALUE</b>	<b>DOUBLE PANE U-VALUE<sup>2</sup></b>
Metal	Operable	1.28	0.87
Metal	Fixed	1.19	0.72
Metal	Greenhouse/garden window	2.26	1.40
Metal	Doors	1.25	0.85
Metal	Skylight	1.72	0.94
Metal, Thermal Break	Operable		0.71
Metal, Thermal Break	Fixed		0.60
Metal, Thermal Break	Greenhouse/garden window		1.12
Metal, Thermal Break	Doors		0.64
Metal, Thermal Break	Skylight		0.80
Nonmetal	Operable	0.99	0.60
Nonmetal	Fixed	1.04	0.57
Nonmetal	Doors	0.99	0.55
Nonmetal	Greenhouse/garden windows	1.94	1.06
Nonmetal	Skylight	1.47	0.68

<sup>1</sup> Metal includes any field-fabricated product with metal cladding. Nonmetal-framed manufactured fenestration products with metal cladding must add 0.04 to the listed U-value. Nonmetal frame types can include metal fasteners, hardware, and door thresholds. Thermal break product design characteristics are:

- The material used as the thermal break must have a thermal conductivity of not more than 3.6 Btu-inch/hr./ft<sup>2</sup>/°F,
- The thermal break must produce a gap of not less than 0.210 inch, and
- All metal members of the fenestration product exposed to interior and exterior air must incorporate a thermal break meeting the criteria in Items a. and b. above.

In addition, the fenestration product must be clearly labeled by the manufacturer that it qualifies as a thermally broken product in accordance with this standard.

<sup>2</sup>For all dual-glazed fenestration products, adjust the listed U-values as follows:

- Subtract 0.05 for spacers of 7/16 inch or wider.
- Subtract 0.05 for products certified by the manufacturer as low-E glazing.
- Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.
- Add 0.05 to any product with true divided lite (dividers through the panes).

**TABLE 1-E—DEFAULT SOLAR HEAT GAIN COEFFICIENT**

FRAME TYPE	PRODUCT	GLAZING	TOTAL WINDOW SHGC	
			Single Pane	Double Pane
Metal	Operable	Uncoated	0.80	0.70
Metal	Fixed	Uncoated	0.83	0.73
Metal	Operable	Tinted	0.67	0.59
Metal	Fixed	Tinted	0.68	0.60
Metal, Thermal Break	Operable	Uncoated	0.72	0.63
Metal, Thermal Break	Fixed	Uncoated	0.78	0.69
Metal, Thermal Break	Operable	Tinted	0.60	0.53
Metal, Thermal Break	Fixed	Tinted	0.65	0.57
Nonmetal	Operable	Uncoated	0.74	0.65
Nonmetal	Fixed	Uncoated	0.76	0.67
Nonmetal	Operable	Tinted	0.60	0.53
Nonmetal	Fixed	Tinted	0.63	0.55

SHGC = Solar Heat Gain Coefficient.